$b\bar{b}$ in $p\bar{p}$?

What do we know?

- Scarse and old literature, rough estimates:

P. Dalpiaz, M. Fabbri and E. Luppi
Fine Bottomonium Spectroscopy in ppbar Annihilation, Proceedings of the Workshop on Nucleon-Antinucleon Interactions, (Moscow, ITEP, 8-11 July 1991) pag. 1486

Branching ratios

$$\frac{Br(b\bar{b} \to p\bar{p})}{Br(c\bar{c} \to p\bar{p})} \approx \left(\frac{m_c}{m_b}\right)^8 \approx 10^{-4}$$

$$\frac{Br(b\bar{b} \to p\bar{p})}{Br(c\bar{c} \to p\bar{p})} \approx \left(\frac{m_c}{m_b}\right)^{10} \approx 10^{-5}$$

$$J^{PC} = 1^{--}, 1^{++}, 2^{++}$$

$$J^{PC} = 0^{-+}, 0^{++}, 1^{+-}$$

Cross sections

$$\sigma(p\bar{p} \to \eta_b) \approx 2\,pb$$

$$\sigma(p\bar{p} \to \Upsilon) \approx 100\,pb$$

$$\sigma(p\bar{p} \to \chi_b) \approx 10\,pb$$

- Hopefully, new limits will be *(soon)* set
  - CLEO III $\Upsilon(1,2,3S) \to$ppbar ($\approx 10^{-6}$)
  - CLEO-c $\psi(3770) \to$ppbar ($\approx 10^{-6}$)

From a presentation by Sandra Malvezzi to Villars SPSC meeting 09/2004

$b\bar{b}$ in $p\bar{p}$?

A word of caution

- Many experimental challenges foreseen:
  - Luminosities about 10^{32} will give ~10 Mhz hadronic rates
  - Detection of exclusive EM channels: very fast detectors, excellent e and μ ID.
  - Narrow resonance width require ultracool pbar beams $dP/P<10^{-4}$

- Machine requirements:

  interaction rate is high enough to require debunched beams

  - minicollider : 5+5 GeV ppbar collider with state of the art cooling
  - fixed target: storage of antiprotons with E_{beam} ~ 45 to 55 GeV.

    Acceleration or deceleration to the resonance energy

Bottomonium from ppbar

Physics Goals:
- complements e+e- studies on such system.
- can measure more precisely masses and widths of P states
- unique alternative in etab searches

Physics challenges:
- Luminosities about 1.E32 will give ~10 Mhz hadronic rates:
- Detection of exclusive EM channels : very fast detectors, excellent
  electron + muon ID.
- Narrow resonance width require ultracool pbar beams dP/P<1.E-4
- Peak Cross Sections (detecting EM final states) will be:
  Upsilons: ~0.1 pb (BRin/1.E-6)/(dP/P/1.E-4)
  Chi-B: ~1 pb (BRin/1.E-6)
  Eta-B: ~.05 pb (BRin/1.E-6) * (BRout/1.E-3)

---> CLEO can measure BRin at 1.E-6 with currently available data
  29 M Y(1S), 9 M Y(2S), 6 M Y(3S).

---> Dalpiaz et al: bbbar/ccbar ~ 10-4 => BR ~ 1.e-7 or below.

- Machine requirements: interaction rate is high enough to require debunched beams
  minicollider : 5+5 GeV ppbar collider with state of the art cooling
  fixed target: storage of pbars with Ebeam ~ 45 to 55 GeV.
  Acceleration or deceleration to the resonance energy